Muesebeck, C. F. W. 1967. *in* Krombein *et al.*, Hymenoptera of America north of Mexico, Synoptic Catalog, Second Supplement. U. S. Dept. Agr., Agr. Monogr. 2:47.

——— *and* **L. M. Walkley.** 1951. *in* Muesebeck *et al.*, Hymenoptera of America north of Mexico, Synoptic Catalog. U. S. Dept. Agr., Agr. Monogr. 2: 148.

Sanders, D. P. *and* **R. C. Dobson.** 1966. The insect complex associated with bovine manure in Indiana. Ann. Ent. Soc. Amer. 59(5):955–959.

HAMOPHTHIRIUS GALEOPITHECI MJÖBERG REDISCOVERED; WITH THE DESCRIPTION OF A NEW FAMILY OF SUCKING LICE (ANOPLURA: HAMOPHTHIRIIDAE)

PHYLLIS T. JOHNSON, *Center for Pathobiology, School of Biological Sciences, University of California, Irvine, California 92664*

ABSTRACT—The genus *Hamophthirius* Mjöberg, and species *H. galeopitheci* Mjöberg, from a Bornean dermopteran, *Cynocephalus variegatus*, are redescribed, and a new family, **Hamophthiriidae**, named to contain the species. *H. galeopitheci* is of primary occurrence on *C. variegata* and is not related to either the hoplopleurid lice infesting tree shrews and lemurs, or to the primate-infesting lice: *Pthirus*, *Pediculus*, and *Pedicinus*. Therefore, the structure of *Hamophthirius* offers no new evidence of relationships amongst lice found on insectivores and primates. However, since dermopterans and bats are considered to have arisen from the same stock, the presence of a primary anopluran species on a dermopteran suggests that absence of Anoplura on bats represents a secondary loss.

The problem of affinities of the insectivores and primates has been approached on the part of entomologists through a study of their lice. Some seemingly obvious relationships amongst the Anoplura of tree shrews and lemurs have encouraged students of the Anoplura to hope that the enigmatic *Hamophthirius galeopitheci* Mjöberg—not seen since originally described—might prove to be another connecting link between the insectivores and the primates. *H. galeopitheci* was from *Cynocephalus* (= *Galeopithecus*) *variegatus* (Audebert), a member of the order Dermoptera, which has been called by Buettner-Janusch (1963) "[possibly] a second line of effort in the attempt to develop a primate type." Furthermore, dermopterans or flying lemurs are regarded by Simpson (1945) as being derived from the same stock as the Chiroptera (bats), but chiropterans do not have anopluran ectoparasites. Since bats do have many other ectoparasites including very specialized dipterans and hemipterans, the lack of lice has puzzled ecto-

parasitologists. There has been no clue as to whether absence of lice on bats was primary or secondary. Hopkins (1949) voiced the opinion that if *H. galeopitheci* were found to be of primary occurrence on the flying lemur, the absence of lice on bats must then be secondary.

The types of *Hamophthirius galeopitheci* apparently have been lost. Although Mjöberg's original description is good so far as it goes, the accompanying inadequate and misleading drawings made it impossible to assume much more than that *H. galeopitheci* was a species of Anoplura although Ferris (1932 and 1951) postulated that it was related to *Docophthirus* Waterston and *Lemurphthirus* Bedford on the basis of head shape.

In 1960 Dr. R. E. Kuntz, then with NAMRU-2 in Formosa, made a collecting trip to British North Borneo. While there he obtained a specimen of *Cynocephalus variegatus*, the type host of *H. galeopitheci*. The animal was infested with a good number of anoplurans which were easily identified as *Hamophthirius galeopitheci* Mjöberg by reference to the original description.

The distinct features of *Hamophthirius* make it evident that the louse is of primary occurrence on *Cynocephalus* and furthermore, necessitate the creation of a new family to contain the species. A description of the family and redescriptions of the genus *Hamophthirius* and species *H. galeopitheci* follow.

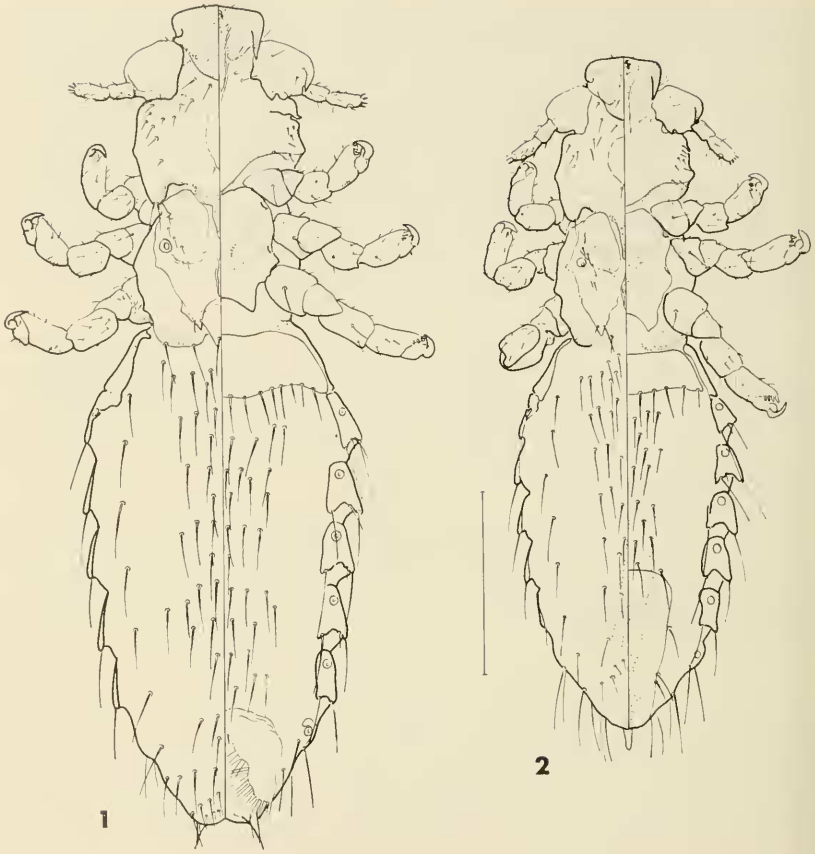
Hamophthiriidae, n. fam.

Description: Anoplura without external evidence of eyes. Antennae not sexually dimorphic, three-segmented in only known species; the two sensoria usually associated with segments 4–5 present on ultimate segment. Occipital apophysis of head present, undivided. Thorax dorsally with well defined notal pit; prothoracic tergal and sternal apophyses both well developed, and both associated with definite apophyseal pits; mesothoracic sternal apophysis and indication of pit also present. Thoracic sternal plate present. Legs essentially equal in size; tibiotarsal separation evident; tarsal claw with rounded protuberance basally to the side of the true claw; internal surface of tarsus (opposing the tibial "thumb") with a raised sensory disc and modified setae; tibial "thumb" with several short, blunt, blade-like apical setae. Majority of abdominal segments lacking plates both dorsally and ventrally; abdominal derm scalloped or reticulate. Paratergal plates present on at least some of abdominal segments, with the apices free. Abdominal spiracles with internal ledges. Female with definite gonopods on eighth segment and apical appendages on ninth segment; apparently lacking spermatheca. Male genital plate present, entire; parameres of aedeagus free distally.

Hamophthirius Mjöberg, 1925

Hamophthirius Mjöberg, 1925, Psyche 32: 283. Ferris, 1932, Contrib. toward a monogr. of the sucking lice, Part 5: 306.

Hamophthirus [sic!]: Ferris, 1951, The Sucking Lice, p. 183.



Figs. 1–2. *Hamophthirius galeopitheci* Mjöberg: 1, female; 2, male. Figures 1–2 to the same scale: the line equals 0.5 mm.

Description: Head and thorax heavily sclerotized. Antennae three-segmented, first segment enlarged and bearing stout, posteriorly directed hook at antero-distal angle. Head with similar hook at antero-distal angle; strongly broadened posterior to antennae. Mouthparts ventral in adult, situated at anterior end of a narrow, longitudinal depression. Thoracic sternal plate large, postero-apically free from body wall. One large sternal plate on second abdominal segment; other unmodified abdominal segments lacking plates. Functional spiracles on third through eighth abdominal segments. Paratergal plates, with free apices, on segments 3–7, those of second abdominal plate connected to paratergal plates of third segment. Typical abdominal segments with 2 short rows of setae dorsally and ventrally in only known species. Genital segments of male and female as in family.

Type-species of genus: *Hamophthirius galeopitheci* Mjöberg, 1925.

Hamophthirius galeopitheci Mjöberg, 1925

Hamophthirius galeopitheci Mjöberg, 1925, Psyche 32: 283. Ferris, 1932, Contrib. toward a monogr. of the sucking lice, Part 5: 307–308, fig. 187.
Hamophthirus [sic!] *galeopitheci*: Ferris, 1951, The Sucking Lice, p. 183.

Type data: Type series from *Galeopithecus* sp. [*Cynocephalus variegatus*], Fesselton [Jesselton], British North Borneo.

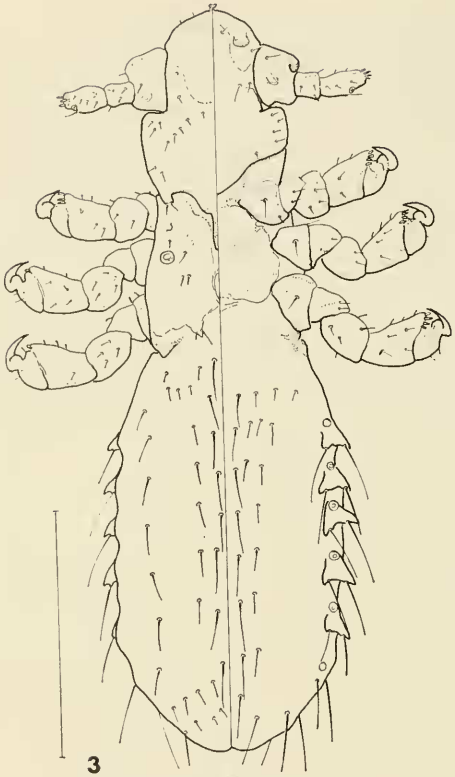
Specimens examined: A series of 3 males, 20 females, and 10 nymphs from *Cynocephalus variegatus*, Ranau, British North Borneo, 20 September 1960, R. E. Kuntz collector, no. PJ9477.

Description: Male (fig. 2): Head (fig. 10, female) dorsally and posterior to anterolateral hook but before antennal insertion, with small rounded lateral lobe bearing several thin setae; with definite anterodorsal head plate which is rounded posteriorly. Dorsally, posterior to antennae, with small oblate sclerotized plate medially. Ventrally, just posterior to postantennal angle, head margins with acutely triangular earlike lobe directed posteriorly. On each side occiput extended posterolaterally into lobe bearing 3 medium-sized setae. Lateral postantennal area with about 10 medium-sized setae on each side; ventrally lateral postantennal area with about 7 smaller setae. Thoracic sternal plate (fig. 8, female) large, with pronounced subacute apicolateral angles. Joined nota of meso- and metathorax extended posteriorly into 2 acute lateral lobes, each bearing 2 subapical setae (fig. 7, female). Tibial thumb of first pair of legs with 5 short modified apical setae; other pairs of legs with 4 such setae (fig. 12, A, B). Sternal plate of first abdominal segment with posteroapical row of 12–13 setae. Dorsally with 1 lateral seta on each side of segments 2–8, these separated from medial rows and near paratergal plates. Paratergal plate II apically joined to paratergal plate III, and with vestige of spiracle; plates III–VII with lateral apices extended into short points; apical setae borne near these points; plates III–V with 3 apical setae, the medial one much smaller than others; plates VI–VII with 2 apical setae; plate VIII reduced, lacking free points apically. Genital plate an acute triangle with rounded angles. Aedeagus (fig. 6) with parameres hooked apically; pseudopenis long, narrowly tapered apically, basally divided into 2 elongate arms, each arm apparently with a central articulation or break, at this break the proximal part is extended apicolaterally into a short acute lobe.

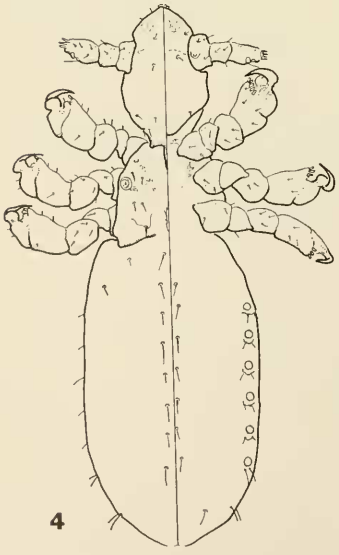
Female (fig. 1): As male except abdominal setae somewhat more numerous; paratergal plates III with 4 apical setae, and plates IV–VI with 3 apical setae; plate VII with 2 apical setae (fig. 5). Genitalia as in fig. 11; apical lobe of ninth segment with 1 subapical seta.

Nymph: All of the three stages with legs essentially as in adult. Notal pit present in all; spiracles present on abdominal segments 3–8; paratergal plates present on segments 3–7. Sternal plate of abdominal segment 2 not developed. Prothoracic sternal and tergal apophyses developed in all stages but mesothoracic ones not developed in first stage and weakly developed or missing in older stages. In all stages, mouthparts are anterior, not ventral. Hooks of head and antenna missing.

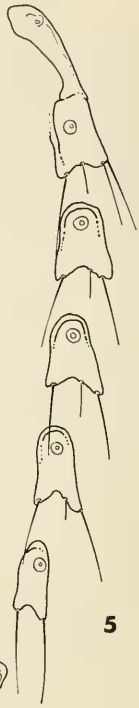
Stage Three (fig. 3): Head narrower posteriorly than adult, but lateral expansion evident; setation much as adult but setae smaller. Thoracic sternal plate present but not heavily sclerotized. Typical abdominal segment dorsally with



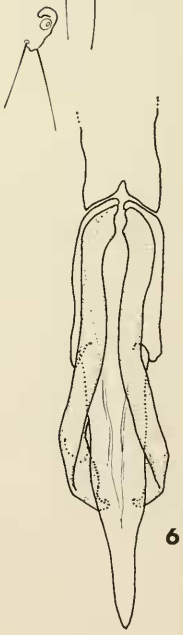
3



4



5



6

lateral seta near paratergal plate and medially with 2 definite rows of setae, the anterior row of 2 long medial and 2–3 shorter lateral setae on each side. Ventrally typical segment with 1 apparent row containing 2 long medial and 2–3 small lateral setae. Paratergal plates III–VII similar to those of adult except smaller and with only 2 apical setae.

Stage Two: Similar to third stage except smaller, head narrower and with fewer setae, and size difference between large median setae of abdominal rows and smaller lateral setae more marked.

Stage One (fig. 4): Postantennal area scarcely broadened, with only a few small setae. Thoracic sternal plate absent. Typical abdominal segment with 2 median setae both dorsally and ventrally. Paratergal plates III–VII barely indicated posteromarginally, each with 2 apical setae.

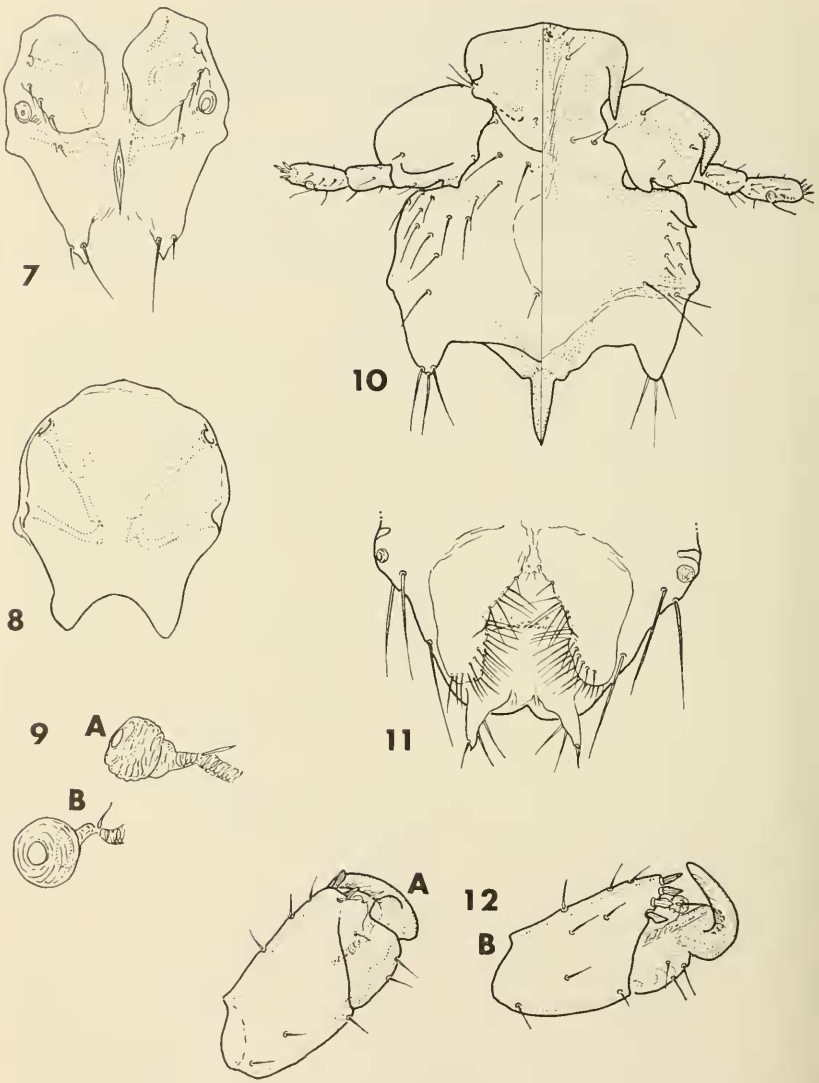
The affinities of *Hamophthirius galeopitheci* are obscure. The thorax is of a generalized type. I consider the retention of the thoracic apophyses (or phragmata) (figs. 7, 8) in particular as a primitive, non-specialized character. The protuberances on the base of the tarsal claws (fig. 12, A, B) could be either the vestiges of a second claw or a specialized development, but the marked division of the tibia from the tarsus as well as the similarity in size of the legs, must be primary characters. The three-segmented antennae are an obvious specialization. The female and male genitalia are of a generalized form, with the retention by the female of well developed gonopods on the eighth segment and terminal lobes of the ninth segment, and in the male, a non-specialized aedeagus with distally free parameres. Loss of abdominal plates and coalescence of antennal segments occurs sporadically throughout the Anoplura, as does the presence of a notal pit.

The pronounced prothoracic sternal pits are reminiscent of the Haematopinidae Enderlein as are the female genitalia and the possession of an occipital head apophysis (Qadri, 1948, believes these to be phragmata of the prothorax). Otherwise, the two families depart radically in the form of the legs, the head, the male genitalia, the paratergal plates, the abdominal spiracles, etc.

Like the Linognathidae Webb, the spiracles of Hamophthiriidae have internal ledges which appear like rings (fig. 9 A, B), abdominal plates are lacking on the majority of the segments, and the two families have somewhat similar male and female genitalia. However, *Linognathus* Enderlein and allies lack the occipital head phragma and a thoracic sternal plate, and the tarsi are very different, with the seta on the tibial thumb either missing or unmodified in linognathids. The head of *Linognathus* is also very different in appearance, and the male genital plate, when present, is not entire but either has a lacuna cen-

←

Figs. 3–6. *Hamophthirius galeopitheci* Mjöberg: 3, third stage nymph; 4, first stage nymph; 5, paratergal plates II–VIII, female; 6, aedeagus, male, ventral view. Figures 3–4 to same scale: the line equals 0.5 mm.



Figs. 7–12. *Hamophthirius galeopitheci* Mjöberg: 7, thoracic dorsum, female; 8, thoracic sternal plate, female; 9, abdominal spiracles, female: A, third segment; B, fourth segment; 10, head, female; 11, female genitalia, ventral view; 12, tibia-tarsus: A, dorsal view of first leg, female; B, ventral view of third leg, male.

trally or consists of an apical band plus two lateral processes extending anteriorly.

Pediculus Linnaeus and *Pthirus* Leach are not obviously related to *Hamophthirius*, nor is *Pedicinus* Gervais. The obvious differences

between these groups and Hamophthiriidae are even greater than between the Linognathidae and Haematopinidae on one hand, and Hamophthiriidae on the other.

Typical members of the Hoplopleuridae Ferris are even further removed. The thorax, sclerites of the head and its setation, the genitalia, and the legs are all widely divergent in the two families. For example, a pronotum is often present in hoplopleurids, and the metanotum is well developed and entire across the median part of the thorax, with the notal pit, if present, found within the notal sclerite. In particular, *Hamophthirius* is not closely related to the genera described from tree shrews (tupaiids) and lemurs (Lemuriformes).

An example of what may be retention of primary characters or convergent evolution occurs with *Hamophthirius* and two genera of the Echinophthiriidae Enderlein, which infests pinnipeds (sea lions and seals). *Lepidophthirus* Enderlein and *Echinophthirius* Giebel both have the tibial thumb with several broadened, short setae rather than the single seta that is usual in Anoplura. There is also a very strong tendency through the Echinophthiriidae for the tarsal claw to have a basolateral lobe similar to that present in Hamophthiriidae. Whether this feature represents a held-over primitive character or convergent evolution is not clear. *Hybophthirus notophallus* (Neumann) from *Orycteropus afer* (Pallas), the aardvaark, also has modified, rather leaflike setae on the tibial thumb. In this species the tarsal claw of the first leg has a short clawlike structure arising beside the true claw (as does *Scipio* Cummings, from African rodents). The aardvaark is a relict mammal belonging to the order Tubulidentata, most of whose species are no longer living. Like the lice of pinnipeds and of *Cynocephalus*, *Hybophthirus* probably has been separated from the other Anoplura for a very long time.

To conclude, in my opinion there are no obvious relationships between the Hamophthiriidae and any particular group of the sucking lice although the hoplopleurids are probably further removed than the haematopinids and linognathids, and there may be a relationship with the echinophthiriids. Most characters held in common seem to be either of a general primitive nature or the result of sporadic convergent evolution.

References

Buettner-Janusch, J. 1963. *in* Buettner-Janusch, J. (ed.), Evolutionary and Genetic Biology of Primates. Academic Press, New York. Chapter I. An Introduction to the Primates, pp. 1–64.

Ferris, G. F. 1932. Contributions toward a monograph of the sucking lice. Part V. Stanford Publ. Biol. Sci. 2(5): 273–413.

———— 1951. The Sucking Lice. Mem. Pacific Coast Ent. Soc. 1: 1–320.

Hopkins, G. H. E. 1949. Host-associations of the lice of mammals. Proc. Zool. Soc. Lond. 119: 387–604.

Mjöberg, E. 1925. A new genus of sucking lice. Psyche 32: 283–284.
Qadri, M. A. H. 1948. *in* Mirza, M. B. (ed.), On Indian Insect Types. Aligarh Muslim Univ. Publ. (Zool. Series). I. External and internal anatomy of the buffalo-louse, *Haematopinus tuberculatus* Burmeister, pp. 1–21, pls. I–IX.
Simpson, G. G. 1945. The principles of classification and a classification of mammals. Bull. Amer. Mus. Nat. Hist. 85: i–xvi, 1–350.

NOTES ON SOME ROGADINE GENERA
(HYMENOPTERA: BRACONIDAE)[1]

R. D. SHENEFELT, *Department of Entomology, University of Wisconsin, Madison, Wisconsin 53706*

ABSTRACT—The present status of the genus *Rogas* is discussed. *Bracon gasterator* of Jurine is redescribed. *Aleiodes* and *Heterogamus* are removed from *Rogas* and the characters of the generic types given. Features of *Cystomastax*, *Megarhogas*, *Macrostomion* (including *bicolor*) are stated, being based upon examination of the type specimens. *Acanthorhogas*, *Brachycentrus* Szépligeti 1907, *Neoclinocentrus*, *Semirhytus* and *Mesocentrus* are removed from the Rogadinae and their characters as represented in the types are reviewed.

The braconid subfamily Rogadinae was formally recognized as a distinct entity within the cyclostome section by Förster in 1862 when he designated the group as the "Family Rogadoidae." In 1836 Haliday had used the name *Rogas* Nees von Esenbeck in a very broad sense, including as subgenera *Spathius* Nees, *Doryctes* Haliday, *Heterospilus* Haliday, *Hecabolus* Haliday, *Chremylus* Haliday, *Hormius* Nees, *Rhyssalus* Haliday, *Colastes* Haliday, *Clinocentrus* Haliday, *Rogas* and *Ademon* Haliday. Förster regarded these as distinct genera and relegated most of them to other "Families," including in the Rogadidae only *Petalodes* Wesmael, *Pelecystoma* Wesmael, *Ademon*, *Clinocentrus* and *Rogas*. The subfamily has been treated in various ways by subsequent authors. Some have recognized Rogadinae, Exothecinae, Rhyssalinae, Pambolinae, Hormiinae, Spathiinae and Doryctinae as

[1] Approved for publication by the Director of the Wisconsin Agricultural Experiment Station. Supported in part by funds received from the Wisconsin Department of Natural Resources. Dr. Ch. Ferrière kindly made it possible for me to study the unique specimen of Jurine's *Bracon gasterator* which is housed in the Muséum d'Histoire Naturelle at Genève, Switzerland. Drs. Jenó Papp and L. Móczár arranged for loan of the specimens named by Szépligeti which are discussed. These are preserved in the Hungarian Natural History Museum in Budapest. For the opportunity to study Wesmael's types I am indebted to Mr. A. Collart of the Institut Royal des Sciences Naturelles de Belgique in Brussels.